

| FIRM D                                  |         |
|---|---------|
| 2 vibrating chain sizers, 60-inch ..... | \$3,780 |
| 3 washers .....                         | 18,600  |
| 1 roller sizer .....                    | 16,100  |
| 1 count sizer, 2 lanes .....            | 41,000  |
| 2 carton-sealing machines .....         | 25,000  |
| 2 weigh-o-matics .....                  | 38,000  |
| 1 even flow .....                       | 5,950   |
| 1 rot trap .....                        | 1,835   |
| Rubber belt conveyors:                  |         |
| 12 inch (234 ft) .....                  | 5,616   |
| 18 inch (120 ft) .....                  | 4,320   |
| 24 inch (397 ft) .....                  | 16,176  |
| 36 inch (115 ft) .....                  | 6,210   |
| 48 inch (15 ft) .....                   | 1,080   |
| Aluminum roller conveyors:              |         |
| 12 inch (21 ft) .....                   | 147     |
| 18 inch (21 ft) .....                   | 147     |
| 24 inch (10 ft) .....                   | 90      |
| 36 inch (52 ft) .....                   | 572     |
| 48 inch (20 ft) .....                   | 300     |
| 60 inch (41 ft) .....                   | 820     |
| Total .....                             | 185,743 |

### Ownership and Operating Costs

The ownership and operating costs at the four firms were as follows:

|  | Per year <sup>1</sup> | Per hour |
|--|-----------------------|----------|
| FIRM A                                 |                       |          |
| Ownership costs:                       |                       |          |
| Depreciation <sup>2</sup> .....        | \$15,617.00           | \$26.03  |
| Interest <sup>3</sup> .....            | 4,685.10              | 7.81     |
| Insurance and taxes <sup>4</sup> ..... | 6,246.80              | 10.41    |
| Operating costs:                       |                       |          |
| Power <sup>5</sup> .....               | 3,123.40              | 5.21     |
| Maintenance <sup>6</sup> .....         | 2,342.55              | 3.90     |
| Total .....                            | 32,014.85             | 53.36    |

|  | Per year <sup>1</sup> | Per hour |
|--|-----------------------|----------|
| FIRM B                                 |                       |          |
| Ownership costs:                       |                       |          |
| Depreciation <sup>2</sup> .....        | \$12,500.00           | \$20.83  |
| Interest <sup>3</sup> .....            | 3,750.00              | 6.25     |
| Insurance and taxes <sup>4</sup> ..... | 5,000.00              | 8.33     |
| Operating costs:                       |                       |          |
| Power <sup>5</sup> .....               | 2,500.00              | 4.17     |
| Maintenance <sup>6</sup> .....         | 1,875.00              | 3.13     |
| Total .....                            | 25,625.00             | 42.71    |

| FIRM C                                 |             |         |
|--|-------------|---------|
| Ownership costs:                       |             |         |
| Depreciation <sup>2</sup> .....        | \$22,727.00 | \$37.88 |
| Interest <sup>3</sup> .....            | 6,818.10    | 11.36   |
| Insurance and taxes <sup>4</sup> ..... | 9,090.80    | 15.15   |
| Operating costs:                       |             |         |
| Power <sup>5</sup> .....               | 4,545.40    | 7.58    |
| Maintenance <sup>6</sup> .....         | 3,409.05    | 5.68    |
| Total .....                            | 46,590.35   | 77.65   |

| FIRM D                                 |             |         |
|--|-------------|---------|
| Ownership costs:                       |             |         |
| Depreciation <sup>2</sup> .....        | \$19,734.30 | \$32.89 |
| Interest <sup>3</sup> .....            | 5,920.29    | 9.87    |
| Insurance and taxes <sup>4</sup> ..... | 7,893.72    | 13.16   |
| Operating costs:                       |             |         |
| Power <sup>5</sup> .....               | 3,946.86    | 6.58    |
| Maintenance <sup>6</sup> .....         | 2,960.15    | 4.93    |
| Total .....                            | 40,455.32   | 67.43   |

<sup>1</sup> Based on 600 h (10 weeks at 60 h per week) per year.

<sup>2</sup> Straight-line depreciation based on 10-yr life expectancy.

<sup>3</sup> At 3 percent of total equipment cost or 6 percent of depreciated balance.

<sup>4</sup> At 4 percent of total equipment costs.

<sup>5</sup> At 2 percent of total equipment costs.

<sup>6</sup> At 1.5 percent of total equipment costs.

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# **OPERATING COSTS AT FOUR POTATO PACKING PLANTS**

**Marketing Research Report No. 1072**

**Agricultura  
UNITED STATES DEPA**

## PREFACE

This study is part of a continuing research program of the Agricultural Marketing Research Institute, Agricultural Research Service, designed to find more efficient and less costly methods of handling, processing, packaging, and transporting agricultural products from the producer to the consumer.

Appreciation is expressed to the potato packing firms that participated in this research.

The engineering firms of Stearns, Conrad, and Schmidt of Long Beach, Calif., and the Paul F. Shaffer Company of Miami, Fla., supplied the basic data for this report.

This work was done under the general direction of John C. Bouma, Chief, Market Operations Research Laboratory, Agricultural Marketing Research Institute.

## CONTENTS

|   | Page |
|---|------|
| Summary .....   | 1    |
| Introduction .....  | 1    |
| Methodology .....   | 2    |
| Description of grades of potatoes .....   | 2    |
| Operating characteristics of four potato packing firms .....                      | 3    |
| Firm A .....  | 3    |
| Firm B .....  | 4    |
| Firm C .....  | 6    |
| Firm D .....  | 8    |
| Labor requirements .....  | 11   |
| Firm A .....  | 11   |
| Firm B .....  | 13   |
| Firm C .....  | 13   |
| Firm D .....  | 13   |
| Production rate at four potato packing firms .....                                | 13   |
| Total costs of labor, materials, and equipment at four potato packing firms ..... | 14   |
| Appendix .....  | 19   |
| Allocation of labor costs per hour .....  | 19   |
| Material costs .....  | 25   |
| Equipment costs .....   | 25   |
| Ownership and operating costs .....   | 26   |

# OPERATING COSTS AT FOUR POTATO PACKING PLANTS

By MARVIN D. VOLZ, *industrial engineer*, and JOSEPH P. ANTHONY, JR., *agricultural marketing specialist*<sup>1</sup>

## SUMMARY

This report is concerned with the costs of labor, materials, equipment, and ownership operation at four potato packing plants.

The man-hour production rate at the four firms studied during 1974 ranged from 709.5 to 1,131.4 pounds of potatoes. The highest production occurred at one of the smaller volume potato firms; however, the lowest production was at the firm with the least volume.

In this study the production rate was not necessarily dependent on volume but on other factors, such as (1) scheduling of field and plant crews, (2)

unloading area capacity to avoid delays in feeding the production line, (3) plant layout, (4) crew skill, (5) automatic bag filling and closing, (6) mechanized handling, (7) palletization, and (8) grade-out variation of potatoes.

The costs per unit for labor, materials, and equipment for packing potatoes in master containers with ten 5-pound bags were \$0.971 at firm A and \$0.915 at firm B. Firms C and D were packing six 8-pound and five 10-pound bags in master containers at \$0.986 and \$1.027, respectively.

## INTRODUCTION

Of all fresh vegetables packaged and shipped for fresh consumption, potatoes have the largest volume. In 1974, approximately 34 billion pounds of potatoes were produced in the United States. This represents 5.2 percent of the world's production and places the United States as the fourth leading producer behind the U.S.S.R., Poland, and West Germany, respectively. The United States' production was valued at over \$800 million in 1974.

Individual consumption patterns for potatoes are changing in the United States. A definite trend toward greater consumption of processed potato products and away from fresh potatoes is in evidence. In 1956, per capita potato consumption was 102.7 pounds, with 88.7 pounds or 86.4 percent consumed as fresh and 14.0 pounds or 13.6 percent used for processing. By 1974, per capita consumption had risen to 118.0 pounds, with 45.9 pounds or 38.9 per-

cent for fresh consumption and 72.1 pounds or 61.1 percent for processing into canned, frozen, chipped, or dehydrated products.

This study is part of a total systems evaluation of the costs of marketing potatoes from the producing area to the retail food store.

This report includes the operations at the packing plant after the potatoes are harvested and prior to transportation to the receiver-wholesaler warehouse and is concerned only with table stock potatoes, which are marketed fresh. Most of the table stock is washed and packed in plants usually close to the producing area. The operations consist of (1) washing, (2) damp-drying, (3) presizing, (4) grading, (5) sizing, and (6) packaging. Since small packing plants tend to be antiquated and costly, the trend is toward larger centralized plants. These may be grower-owned or privately owned firms operated by someone not engaged in growing potatoes.

<sup>1</sup> Market Operations Research Laboratory, Agricultural Research Service, Beltsville, Md.

## METHODOLOGY

In this study, ownership and operating costs were analyzed at four potato plants, two in Florida and two in California. Additional operating costs and data were also collected from other firms in Florida, California, Virginia, New York, and Maine.

The labor hours and their respective costs were allocated to the appropriate potato grade in accordance with the function performed by the packing plant personnel. For example, all the labor required to pack 5-, 8-, and 10-pound consumer bags in 48- to 50-pound master containers was allocated by percentage of weight of a given size of consumer bag packed to the total weight of potatoes processed during the study period. Whenever a function served more than one grade of potato, the direct

labor hours were allocated among those grades by percentage of weight of a particular grade to the total weight of the grades involved. All other labor costs were allocated by percentage of weight of the grade packed to the total weight handled per hour. A detailed breakdown of the labor cost calculations is given in the appendix.

Material costs were obtained directly from the manufacturers in 1975. Equipment costs were depreciated on a straight-line basis, with a 10-year life expectancy. The production line hourly rate was an average for the total length of the study (4-16 hours) at the four packing plants. The material, equipment, and ownership and operating costs are given in the appendix.

## DESCRIPTION OF GRADES OF POTATOES

In the U.S. standards for grades of potatoes, all potatoes not meeting the grade specifications<sup>2</sup> are called "unclassified." According to the standards, in section 51.1544 the term "unclassified" is not a grade but is a designation to show that no grade has been provided for potatoes in this category.

TABLE 1.—U.S. standards for grades of potatoes

| Size designation          | Minimum diameter <sup>1</sup> or weight |     | Maximum diameter <sup>1</sup> or weight |     |
|---------------------------|---|-----|---|-----|
|                           | In                                      | Oz  | In                                      | Oz  |
| Size A <sup>2</sup> ..... | 1-7/8                                   | (3) | (3)                                     | (3) |
| Size B .....              | 1-1/2                                   | (3) | 2-1/4                                   | (3) |
| Small .....               | 1-3/4                                   | (3) | 2-1/2                                   | 6   |
| Medium .....              | 2-1/4                                   | 5   | 3-1/4                                   | 10  |
| Large .....               | 3                                       | 10  | 4-1/4                                   | 16  |

<sup>1</sup> Diameter means the greatest dimension at right angles to the longitudinal axis, without regard to the position of the stem end.

<sup>2</sup> In addition to the minimum size specified, a lot of potatoes designated as size A shall contain at least 40 percent of potatoes that are 2-1/2 inches in diameter or larger or 6 oz in weight or larger.

<sup>3</sup> No requirement.

<sup>4</sup> For details on grade specifications, see "United States Standards for Grades of Potatoes, Effective September 1, 1971, as Amended February 5, 1972." This publication can be obtained from the Agricultural Marketing Service, U.S. Department of Agriculture, Washington, D.C. 20250.

Besides disease, shape, damage, and other factors, which are listed in detail in the pamphlet on U.S. standards, size is also a criterion. The following information concerning size can be found in section 51.1545 on page 8 of this publication:

The minimum size or minimum and maximum sizes may be specified in connection with the grade in terms of diameter or weight of the individual potato, or in accordance with one of the size designa-

TABLE 2.—U.S. weight standards for count potatoes

| Size designation <sup>1</sup> | Minimum weight | Maximum weight |
|-------------------------------|----------------|----------------|
|                               | Oz             | Oz             |
| Under 50 .....                | 15             | --             |
| 50 .....                      | 12             | 19             |
| 60 .....                      | 10             | 16             |
| 70 .....                      | 9              | 15             |
| 80 .....                      | 8              | 13             |
| 90 .....                      | 7              | 12             |
| 100 .....                     | 6              | 10             |
| 110 .....                     | 5              | 9              |
| 120 .....                     | 4              | 8              |
| 130 .....                     | 4              | 8              |
| 140 .....                     | 4              | 8              |
| Over 140 .....                | 4              | 8              |

<sup>1</sup> Count per 50-lb carton.

pound cartons, the weight ranges shown in table 2 shall apply. These size designations may be applied to potatoes packed in any size containers provided that the weight ranges are within the limits specified.

**Firm A**

over a 2-inch-diameter screen conveyor-sizer (6), where the size B potatoes fall through and are conveyed to a grading-sizing station (7). Culls are removed and the remaining potatoes pass over a 1-1/4-inch-diameter screen conveyor-sizer (8), where the creamers fall through and into field crates. The No. 1B's are placed in 50-pound baler bags at a double-head bag-filling station (9). The filled bags are conveyed to the bag-closing station (11).

The No. 1A potatoes pass over the 2-inch-diameter screen conveyor-sizer (6) onto the main grading-sizing table (9). Culls are removed and sent by chute to an under-the-floor conveyor system. No. 2 and No. 3 (Jumbo) potatoes are removed and conveyed to a grading-sizing table (9). No. 3's are placed in a chute and manually bagged into 100-pound burlap bags (10). Some of the No. 2 potatoes are manually bagged at the same location. The remaining No. 2's are conveyed to the automatic bag-

1 UNLOADING FIELD TRUCKS

2 FLUME

3 18-INCH-WIDE CONVEYOR

4 SCREEN, SOAK TANK, WASH, WATER EXTRACTOR

5 DRYER

6 2-INCH-DIAMETER SCREEN CONVEYOR-SIZER

7 GRADING AND BAGGING NO. 1B's, NO. 2B's, AND CREAMERS

8 1/4-INCH-DIAMETER SCREEN CONVEYOR-SIZER

9 MAIN GRADING TABLE

10 MANUALLY BAGGING NO. 2's AND NO. 3's

11 AUTOMATIC BAG-CLOSING STATION

12 FOUR-POSITION AUTOMATIC BAGGING STATION FOR NO. 2's

13 MANUALLY BAGGING NO. 1A's - 50-LB. BALER BAGS

14 FOUR-POSITION AUTOMATIC BAGGING STATION FOR NO. 1A's

15 BAGGING 5'-AND 10-LB CONSUMER PACKAGES

16 AUTOMATIC WIRE BAG-CLOSING STATION

17 PLACING CONSUMER PACKS AND CLOSING THEM

18 80-LB. BALER BAGS MA OVAL CONVEYOR

19 AUTOMATIC 50-LB BAL BAG-CLOSING STATION

20 LOADING RAILCARS

21 LOADING TRAILERS

• SHEDWORKER

FIGURE 1.—Plant layout of firm A.

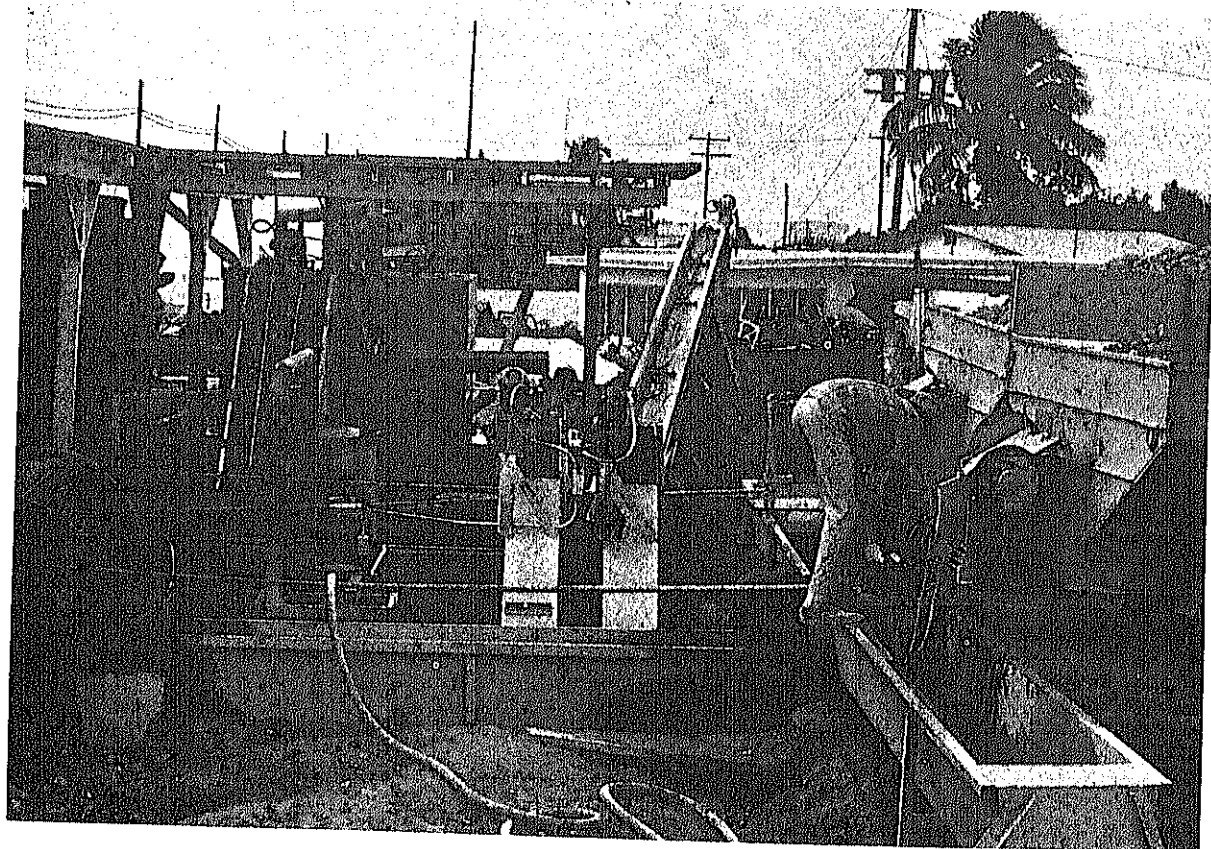


FIGURE 2.—Potatoes being moved by flume and conveyor to main washing area.

PN-5461

filling station (12). The No. 2 and the No. 1B potato baler bags are closed with automatic wire bag-closing equipment (11). They are separately transported by two-wheel trucks to storage or into the trailers (21).

The No. 1A potatoes are moved from the main grading table (9) on a conveyor. The first bagging station (13) has four double-head, manual, bag fillers (fig. 3). The filled baler bags are moved onto an oval accumulating conveyor (18), which moves them to a bag-closing station (19). The second group of bagging stations for No. 1A potatoes is equipped with four-position automatic baler fillers (14). The bags are closed with wire loops (19) and moved by conveyor to a telescoping belt conveyor, which is used in loading trailers and railcars. The third bagging station for No. 1A potatoes is a four-position double-headed bagging line for 5- and 10-pound consumer bags (15). The filled 5- and 10-pound bags are moved on an L-type belt conveyor to an automatic wire closer (16). The bags are conveyed to a rotary table (17) and manually placed in baler bags. The closed

baler bags are handtrucked to trailers or railcars for loading (20, 21).

### Firm B

Firm B is in southern Florida. A layout of the production line is shown in figure 4. Potatoes are unloaded from the field trucks into a hydraulic flume, which moves them to the initial inspection station, where clods, rocks, and culls are removed (1, 2, 3, 4). The remaining potatoes then go into the washer, the water eliminator, and the dryer (5). After drying they pass over a 2-inch-diameter diamond-shaped chain conveyor (6), where all No. 1B's, No. 2B's, and creamers fall through and onto a conveyor-sizer (8).

The No. 2B potatoes are removed and placed in a chute, which terminates at the double-head bag-filling station (7). The No. 1B's and creamers then pass over the 1-1/4-inch-diameter chain conveyor (8), where the creamers fall through onto a chute, which leads to a single-head bag-filling station (9). The remaining 1B potatoes after passing over the

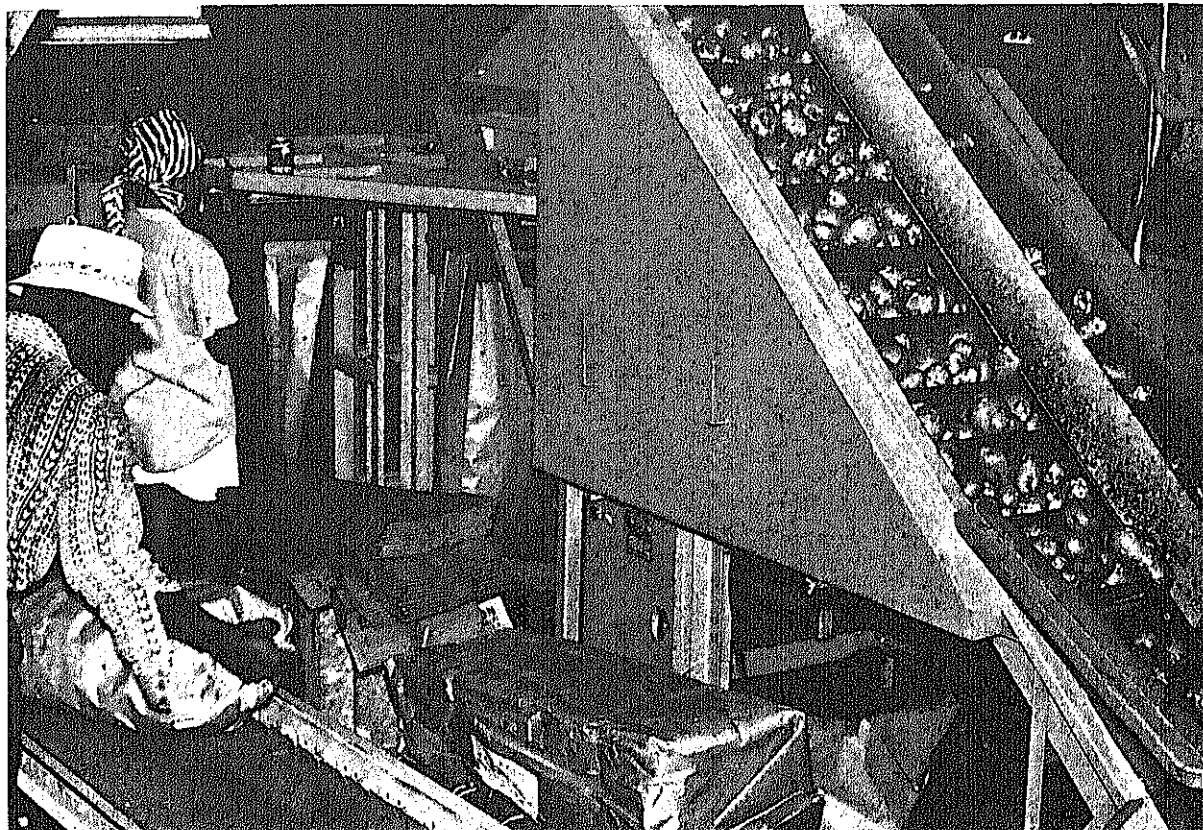


FIGURE 3.—Potatoes being moved to station having four baler bag fillers.

PN-5462

screen (8) are conveyed to a double-head baler bag-filling station (10), where they are placed in 50-pound baler bags. The bags are closed by an automatic wire closing machine (11) and then conveyed to the palletizing area (19).

The No. 1A potatoes pass over the 2-inch-diameter chain conveyor (6) and onto the main grading table (13) (fig. 5). Culls are removed and conveyed to a bin. The No. 2A and No. 3 (Jumbos) potatoes are moved to a grading conveyor, where

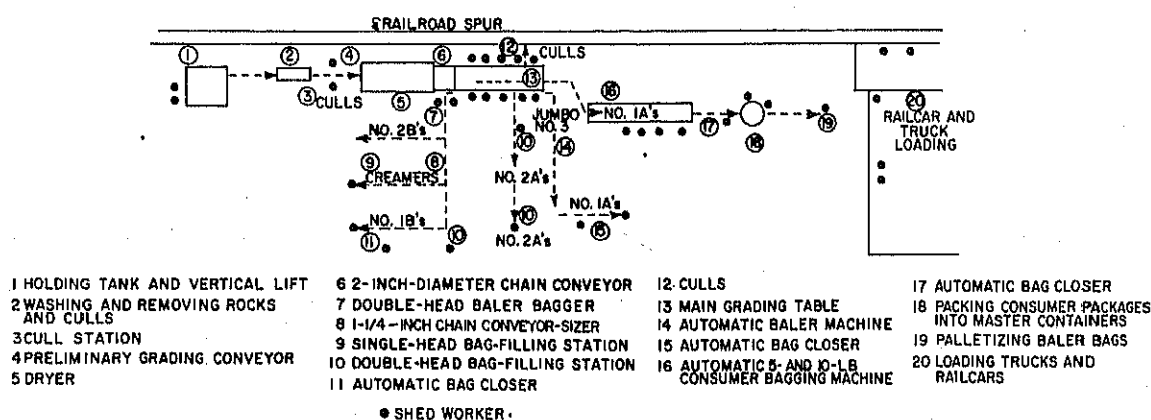


FIGURE 4.—Plant layout of firm B.



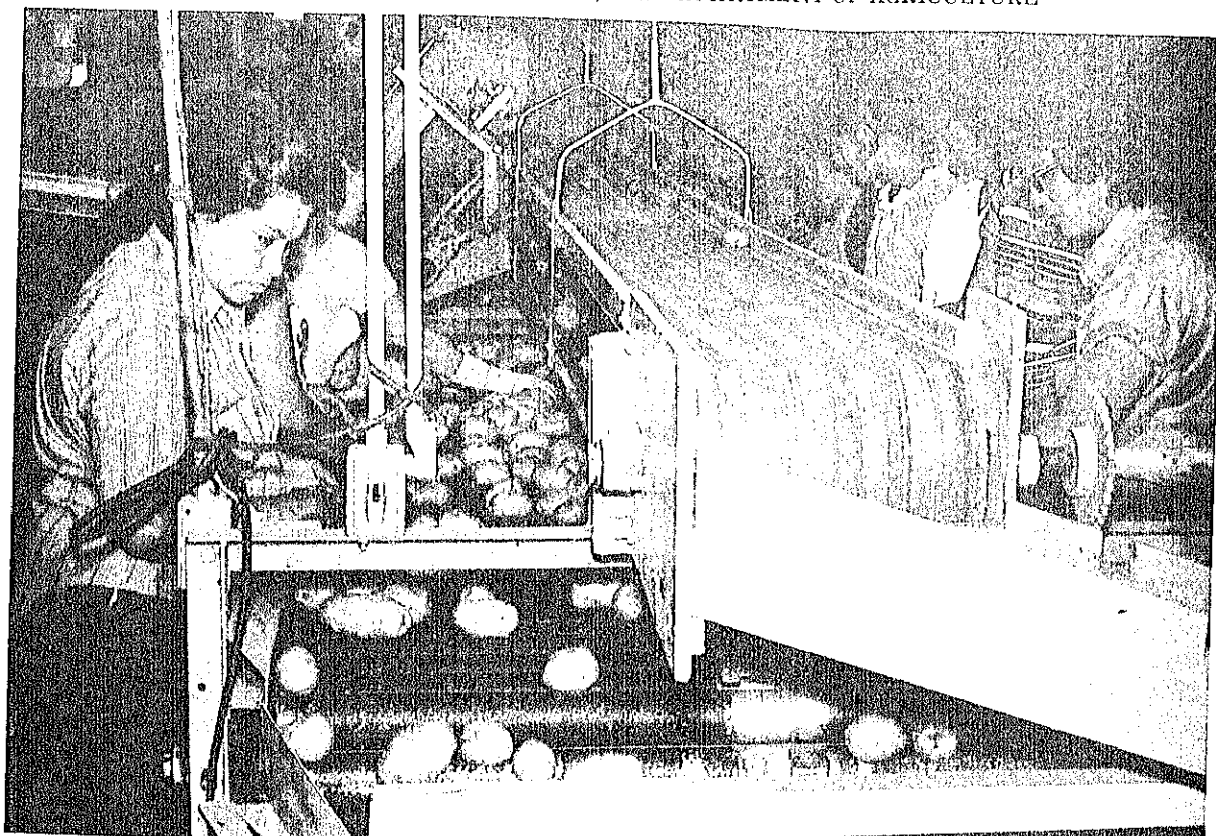


FIGURE 5.—Main grading station.

PN-5463

the No. 3's are placed in 50-pound bags at a double-head baler bag-filling station (14). The No. 2A potatoes are conveyed to a double-head bagging station (15) and placed in 50-pound bags. The bags are then closed and palletized (19).

The No. 1A potatoes are moved from the main grading table (13) either to the six-head packaging line for 5- and 10-pound consumer plastic bags (16) or to the bulk 50-pound automatic baler bag-filling machine (14) (fig. 6).

The 5- or 10-pound consumer bags are closed by an automatic closing machine (17) and are moved by conveyor to a rotary table (18), where they are manually placed in 50-pound baler bags. These filled bags are closed by an automatic wire closure machine and palletized (19).

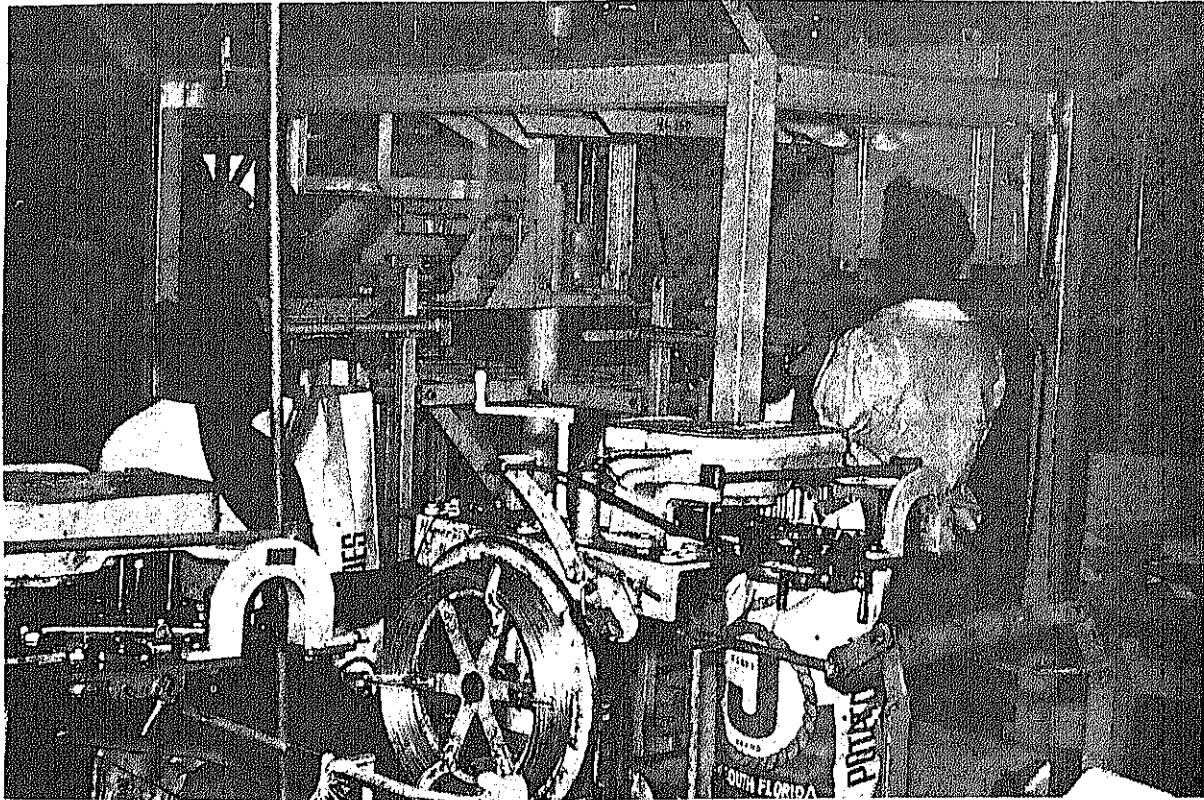
The 50-pound baler bags with No. 1A potatoes are also closed by an automatic wire closure machine (15) and conveyed to a palletizing station in the loading area (19). They are palletized and moved to trailers, railcars, or temporary storage by a forklift truck (20).

### Firm C

Figure 7 shows a plant layout of firm C, which is in California. Incoming potatoes are unloaded from the field truck by using a high velocity water stream, which forces them out of the truck and into a flume. The potatoes are moved by the flume to the initial sizing area, where the B's and "pee wees"<sup>4</sup> are separated (1, 2, 3). The pee wees are conveyed to pallet bins (23), where they are stored for processing as canned potatoes. The B's are conveyed to an automatic bagging machine (19) and then to the railcar loading area (22).

The main stream of potatoes has only No. 1's and No. 2's. They are washed and pass through a roller sizer (7), where small No. 1's are separated from large No. 1's (8). The small No. 1's are packed in 8- or 10-pound consumer bags and placed in 48- and 50-

<sup>4</sup> "Pee wees," a term used to describe potatoes that are less than 1-1/4 inches in diameter.



PN-5464

FIGURE 6.—50-pound baler bagging and closing station

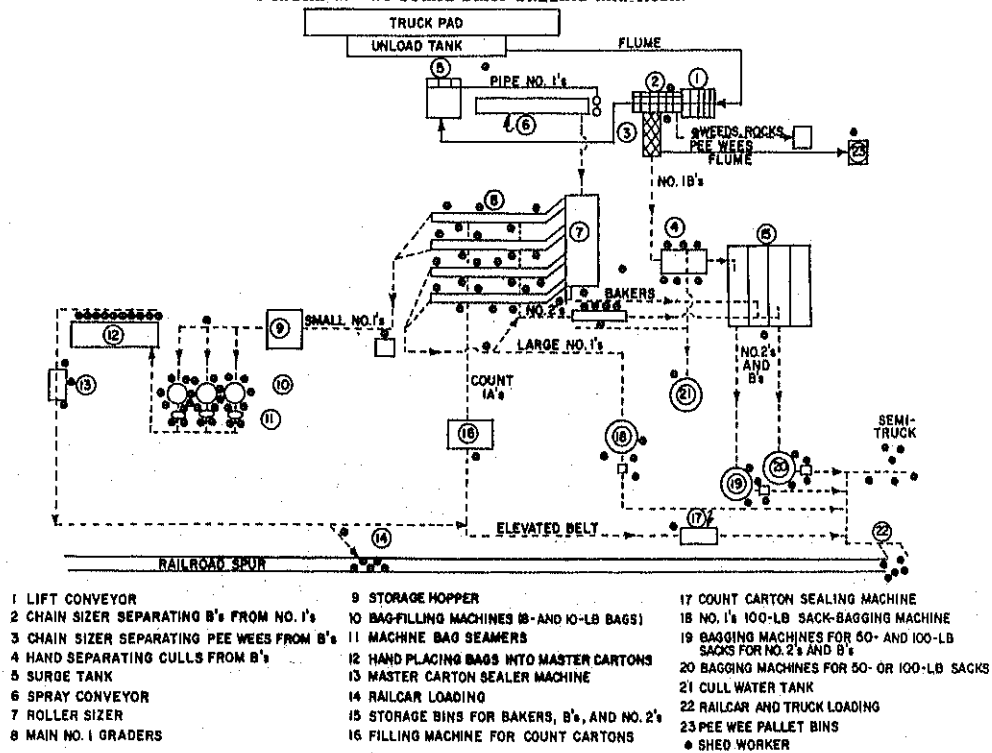


FIGURE 7.—Plant layout of firm C.

pound master containers, respectively. The bakers,<sup>5</sup> count potatoes,<sup>6</sup> and No. 2's are manually removed from the large No. 1's and conveyed to their respective packing areas and from there to the loading areas (14, 22). The large No. 1's are automatically packed in 100-pound burlap bags (fig. 8) and conveyed to the loading area (14). Cull potatoes are removed from each stream of potatoes and eventually conveyed to the cull water tank (21).

All potato packaging and bag stitching at firm C were accomplished with automatic bagging and weighing devices (fig. 9) and sewing machines (10, 11). The only exception was the manual packing of 8- and 10-pound bags into master containers.

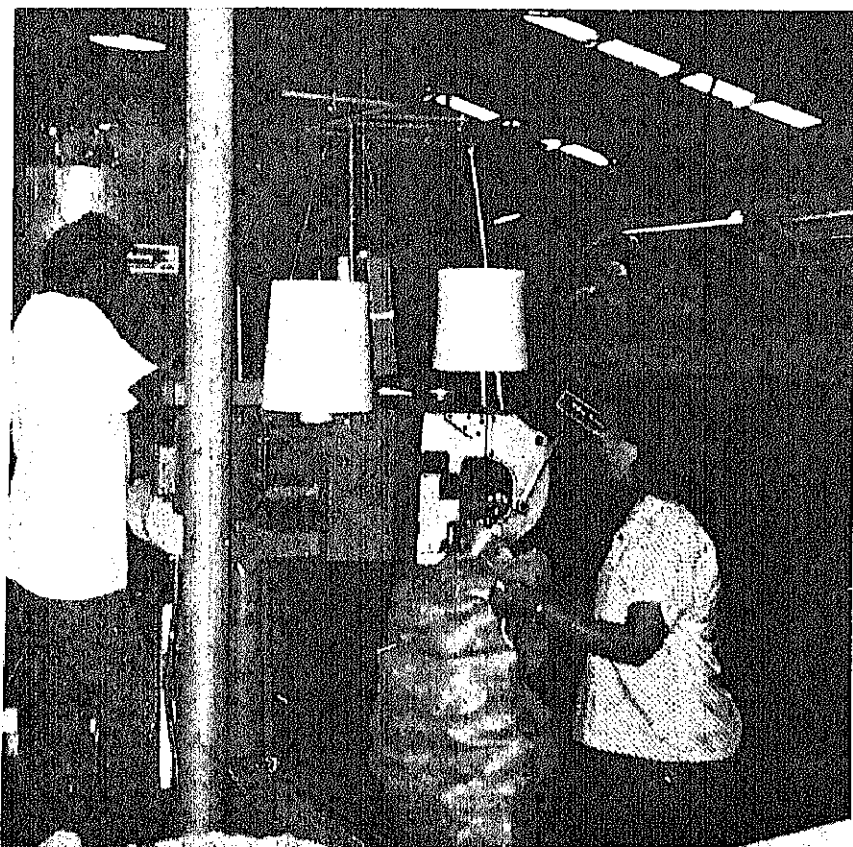
<sup>5</sup> Large No. 1A potatoes that usually are sold to institutional firms.

<sup>6</sup> See table 2.

Most of the packages are transported by conveyor directly to the loading vehicle. At times, handtrucks are used to move burlap bags to the loading area (14, 22).

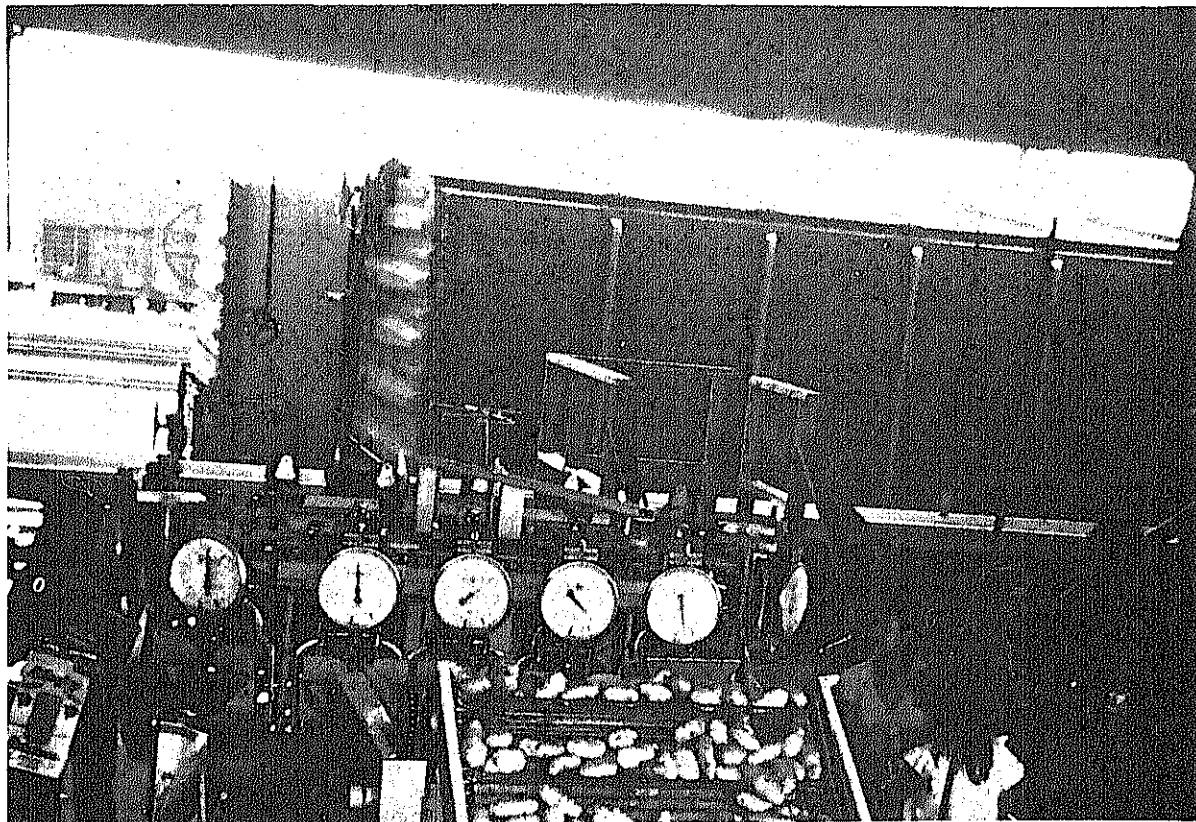
### Firm D

Figure 10 shows the plant layout of firm D in California. The packing operations at this plant were similar to those at firm C except for the following variations: (1) The potatoes were unloaded from the field truck by gravity. A lift hoist (1) at the unloading area tilted the truck body to allow the potatoes to roll into the unloading bin. (2) All burlap bags were stitched manually (7) (fig. 11). (3) The count potatoes were machine sorted (17) for packaging in count cartons (18, 19). (4) All packages were taken to the transport vehicle by a handtruck (fig. 12).



PN-5465

FIGURE 8.—No. 1 potatoes being packed in 100-pound burlap bags.



PN-5466

FIGURE 9.—Potatoes being conveyed to automatic bagging station.

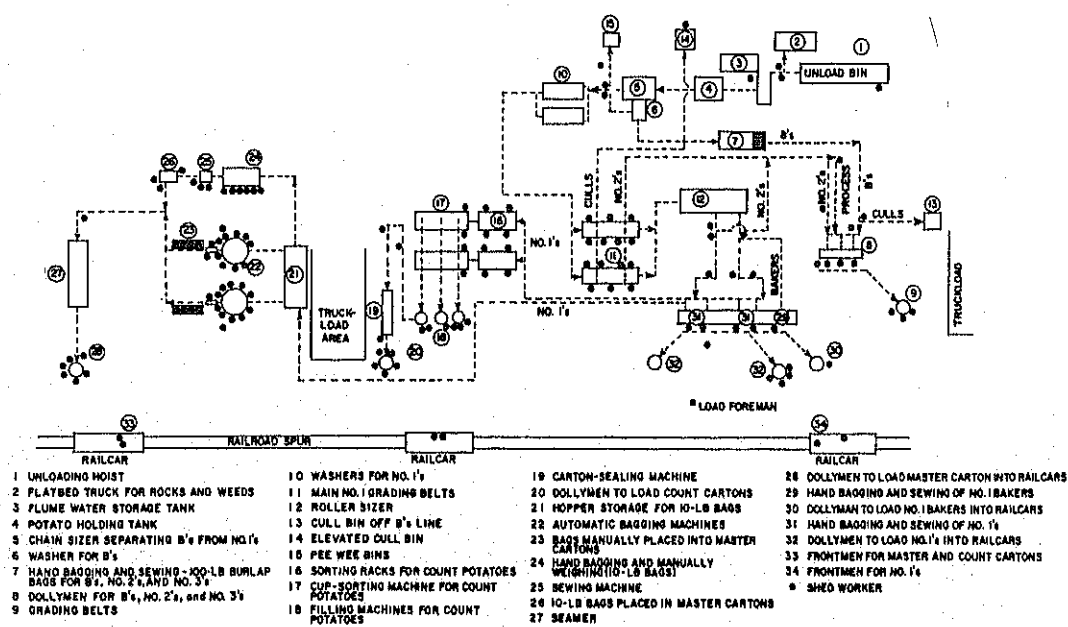


FIGURE 10.—Plant layout of firm D.



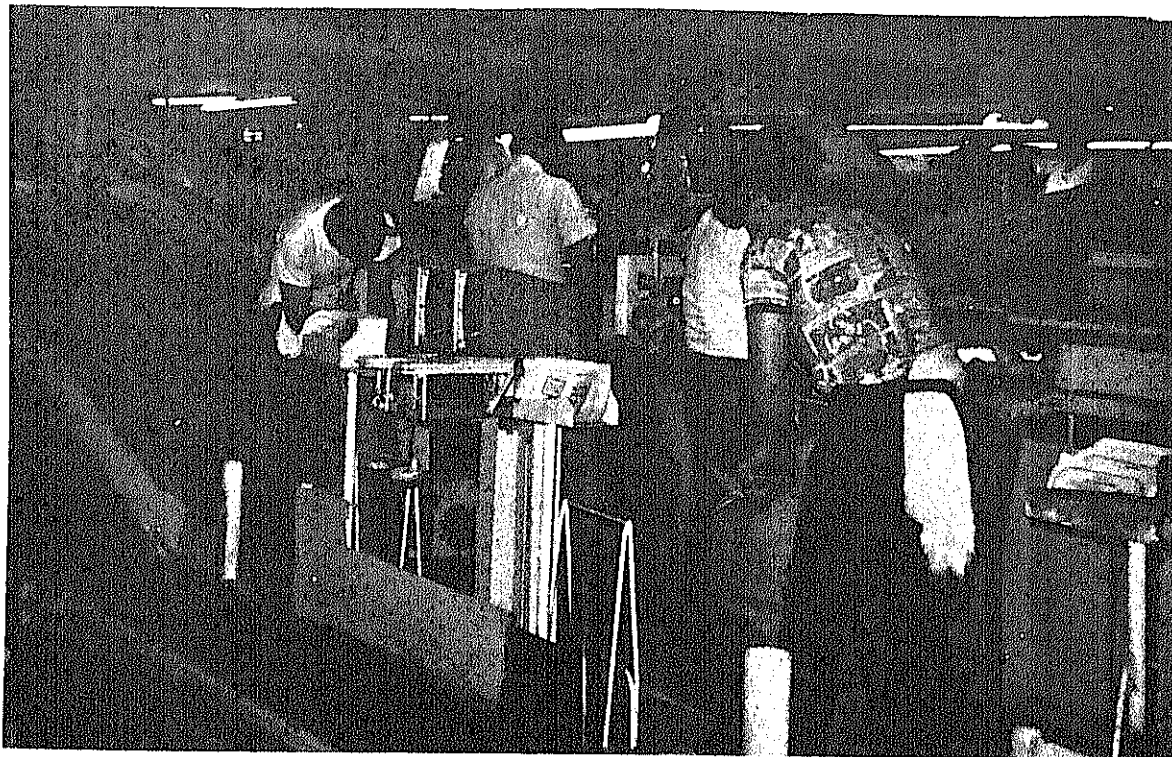


FIGURE 11.—Burlap bags being stitched manually in firm D.

PN-5467

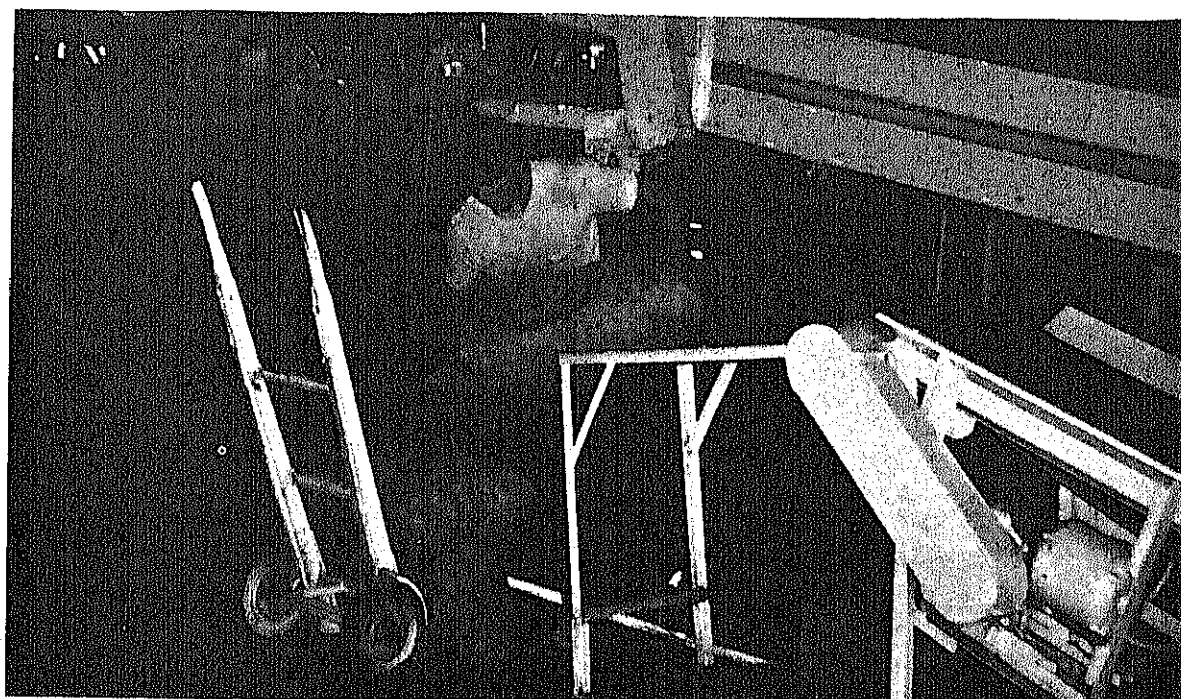


FIGURE 12.—Bags being loaded on handtruck in firm D.

PN-5468

## LABOR REQUIREMENTS

## Firm A

The distribution of labor at firm A is shown in table 3 and figure 1. At firm A, 51 persons were

employed. The wage rates ranged from \$2.25 to \$2.75 per hour (table 4) and were comparable with those of the other three firms studied.

TABLE 3.—Labor distribution in 4 potato packing firms

| Function          | Firm A         | Firm B         | Firm C         | Firm D         |
|-------------------|----------------|----------------|----------------|----------------|
|                   | <i>Percent</i> | <i>Percent</i> | <i>Percent</i> | <i>Percent</i> |
| Unloading .....   | 2.0            | 5.4            | ---            | ---            |
| Grading .....     | 43.1           | 37.8           | 34.2           | 31.4           |
| Packaging .....   | 33.3           | 43.3           | 47.4           | 60.4           |
| Loading .....     | 21.6           | 13.5           | 13.2           | 4.5            |
| Maintenance ..... | ---            | ---            | 5.2            | 3.7            |
| Total .....       | 100.0          | 100.0          | 100.0          | 100.0          |

TABLE 4.—Labor requirements and wage rates at 4 potato packing firms

| Type of employee                 | Employees     | Allocation of labor by function | Hourly wage rates |
|----------------------------------|---------------|---------------------------------|-------------------|
|                                  | <i>Number</i> | <i>Percent</i>                  | <i>Dollars</i>    |
| FIRM A                           |               |                                 |                   |
| Unloader .....                   | 1             | 2.0                             | 2.75              |
| Grading:                         |               |                                 |                   |
| Lead graders .....               | 2             | 43.1                            | { 2.50            |
| Graders .....                    | 20            |                                 | { 2.25            |
| Packaging:                       |               |                                 |                   |
| Baggers (5- or 10-lb bags) ..... | 8             | 33.3                            | { 2.25            |
| Packers .....                    | 5             |                                 | { 2.25            |
| Do .....                         | 2             |                                 | { 2.50            |
| Packers and supervisors .....    | 2             |                                 | { 2.75            |
| Loading:                         |               |                                 |                   |
| Truckers .....                   | 5             | 21.6                            | { 2.50            |
| Loaders .....                    | 6             |                                 | { 2.75            |
| Total .....                      | 51            | 100.0                           | ---               |
| FIRM B                           |               |                                 |                   |
| Unloaders .....                  | 2             | 5.4                             | 2.90              |
| Grading:                         |               |                                 |                   |
| Lead grader .....                | 1             | 37.8                            | { 2.75            |
| Graders .....                    | 13            |                                 | { 2.50            |
| Packaging:                       |               |                                 |                   |
| Baggers (5-lb bags) .....        | 8             | 43.3                            | { 2.50            |
| Packers .....                    | 7             |                                 | { 2.50            |
| Packer .....                     | 1             |                                 | { 2.75            |
| Loading:                         |               |                                 |                   |
| Loaders .....                    | 4             | 13.5                            | { 2.75            |
| Forklift operator .....          | 1             |                                 | { 2.75            |
| Total .....                      | 37            | 100.0                           | ---               |

TABLE 4.—*Labor requirements and wage rates at 4 potato packing firms—*  
Continued

| Type of employee                        | Employees | Allocation of labor by function | Hourly wage rates   |
|---|-----------|---------------------------------|---------------------|
|   | Number    | Percent                         | Dollars             |
| FIRM C                                  |           |                                 |                     |
| Grading:                                |           |                                 |                     |
| Graders .....                           | 37        | 34.2                            | 2.40                |
| Delay monitor .....                     | 1         |                                 | 2.50                |
| Supergrader .....                       | 1         |                                 | 2.60                |
| Packaging:                              |           |                                 |                     |
| Baggers (8- and 10-lb bags) .....       | 23        | 47.4                            | 2.40                |
| Crew chief .....                        | 1         |                                 | 2.50                |
| Baggers (50- and 100-lb bags) .....     | 11        |                                 | 2.75                |
| Sealer .....                            | 1         |                                 | 2.75                |
| Crew chiefs .....                       | 2         |                                 | 3.00                |
| Master container packers .....          | 13        |                                 | 2.75                |
| "Count" carton packers .....            | 2         |                                 | 2.75                |
| Pee wee bin operator .....              | 1         |                                 | 2.75                |
| Loading:                                |           |                                 |                     |
| Loaders .....                           | 12        | 13.2                            | 3.00                |
| Foreman .....                           | 1         |                                 | 4.80                |
| Do .....                                | 1         |                                 | <sup>1</sup> 200.00 |
| Main foreman .....                      | 1         |                                 | <sup>2</sup> .005   |
| Maintenance:                            |           |                                 |                     |
| Helpers .....                           | 2         | 5.2                             | 2.50                |
| Foreman .....                           | 1         |                                 | <sup>3</sup> 700.00 |
| Cleanup and miscellaneous helpers ..... | 3         | ---                             | 2.50                |
| Total .....                             | 114       | 100.0                           | ---                 |
| FIRM D                                  |           |                                 |                     |
| Grading:                                |           |                                 |                     |
| Graders .....                           | 41        | 31.4                            | 2.35                |
| Supervisor .....                        | 1         |                                 | <sup>1</sup> 125.00 |
| Packaging:                              |           |                                 |                     |
| Baggers .....                           | 41        | 60.4                            | 2.35                |
| Master container packers .....          | 4         |                                 | 2.35                |
| Pee wee bin operator .....              | 1         |                                 | 2.75                |
| Sidemen .....                           | 27        |                                 | 2.75                |
| Frontmen .....                          | 8         |                                 | 10.00               |
| Loading:                                |           |                                 |                     |
| Frontmen .....                          | 3         | 4.5                             | 10.00               |
| Foremen .....                           | 3         |                                 | <sup>4</sup> .03    |
| Maintenance:                            |           |                                 |                     |
| Helper .....                            | 1         | 3.7                             | 2.50                |
| Foreman .....                           | 1         |                                 | <sup>3</sup> 700.00 |
| Cleanup and miscellaneous helpers ..... | 3         | ---                             | 2.50                |
| Total .....                             | 134       | 100.0                           | ---                 |

<sup>1</sup> Per week.<sup>2</sup> Per hundredweight.<sup>3</sup> Per month.<sup>4</sup> Per bag or carton loaded.

Labor requirements and the respective costs were allocated to the appropriate potato grade in accordance with the function performed by the plant workers. For example, all the labor required for bagging 5- and 10-pound paper bags was allocated to

packing of master containers. Whenever a function served more than one grade of potato, the labor costs were allocated among those grades on the basis of the respective percentage by weight of a particular grade to the total weight of the grades involved.

For a detailed breakdown of allocating labor costs, see the appendix.

At firm A, 43.1 percent of the 51 men in the labor force were graders and 21.6 percent loaders. Packaging occupied 33.3 percent, the lowest percentage in the study for this operation. The remaining 2.0 percent were unloaders. The primary functions of the firm—grading and packaging—occupied 76.4 percent of the floor labor force. The size of the loading crew, 21.6 percent, seemed excessive when compared with that of the other firms.

### Firm B

At firm B, 37 persons were employed, with wage rates from \$2.50 to \$2.90 an hour (table 4). The distribution of the labor force is shown in table 3 and figure 4.

At this firm, 43.3 percent were assigned to packaging, 37.8 percent to grading, 13.5 percent to loading, and 5.4 percent to unloading. The unloading crew was the largest for the four firms, but it also had some inspection duties. About 81.1 percent of the floor labor force were in grading and packaging operations, the primary functions of the firm.

### Firm C

At firm C, 114 persons were employed as direct labor. The wage rates ranged from \$2.40 to \$3.00 an hour (table 4). The supervisor of the graders was paid \$2.60 hourly. One floor foreman was paid \$200

weekly and another \$4.80 hourly. The foreman of the maintenance section was paid \$700 monthly. The main foreman received a salary based on the volume of potatoes handled at a rate of \$0.005 per hundred-weight.

The distribution of the labor force at firm C is shown in table 3 and figure 7.

At this firm, 47.4 percent of the floor labor force were in packaging, 34.2 percent in grading, 13.2 percent in loading, and 5.2 percent in maintenance. This meant that 81.6 percent of the floor labor force were assigned to grading and packaging, the primary functions of the firm.

### Firm D

Firm D used 134 persons, and its wage rates ranged from \$2.35 to \$10.00 an hour (table 4). The three foremen in the loading section were paid \$0.03 for each bag or carton loaded.

The distribution of the labor force at firm D is shown in table 3 and figure 10.

At this firm, 60.4 percent were in packaging, 31.4 percent in grading, 4.5 percent in loading, and 3.7 percent in maintenance. This was the only firm with most of its floor labor force in the packaging operation. The primary function of grading and packaging occupied the attention of 91.8 percent of the floor labor force with the remaining 8.2 percent in loading and maintenance. The 4.5 percent in loading was small compared with the 16.1-percent average for the other three firms.

## PRODUCTION RATE AT FOUR POTATO PACKING FIRMS

During the study the labor force and plant production per hour and per man-hour were as follows at the four firms:

| Firm    | Labor<br>Number | Production per— |          |
|---------|-----------------|-----------------|----------|
|         |                 | Hour            | Man-hour |
| A ----- | 51              | 57,700          | 1,131.4  |
| B ----- | 37              | 26,250          | 709.5    |
| C ----- | 114             | 96,040          | 842.5    |
| D ----- | 134             | 136,900         | 1,021.6  |

These results show that the man-hour production rate is not necessarily dependent on the hourly volume of the operation. Firm A had the highest man-hour production rate of the four firms studied and yet its total hourly volume of 57,700 pounds was

about one-half the volume of firms C or D. Therefore the production per man-hour seems to be affected by other factors, such as (1) crew scheduling, (2) potato supply, (3) unloading space, (4) plant layout, (5) crew skill, (6) automatic bag-filling and bag-closing equipment, (7) mechanized handling, (8) palletization, and (9) grade-out variation of potatoes.

Detailed studies were not made on what factors affect the production rate in potato packing plants. However, observations and time studies were made of operations at other plants in Florida, California, Virginia, New York, and Maine. The results indicated that some of the following factors could affect the production rate.

For example, a study was conducted on the downtime of the production line at a potato packing



plant in the Long Island, N.Y., area. The line was not running approximately 20 percent of the time, mainly because of the inefficient layout of the receiving line and scheduling of the harvesting crews.

Enough space should be provided at the receiving line or flume for two trucks, so that as soon as one truck is unloaded, the second truck can be unloaded immediately and thereby prevent interrupting the flow of potatoes to the production line. Considerable time is lost when there is only space for one truck at the receiving line. The next truck to be unloaded has to wait until the first one leaves. Then the second truck has to be positioned at the line or flume before it can be unloaded.

The proper scheduling of harvesting crews is essential to insure that a continuous supply of potatoes arrives at the packing plant while the production line is running.

Of course, enough potatoes should be available to keep the line running continuously. If there is a shortage of potatoes, the crew should be scheduled accordingly.

The layout of the line as well as the skillfulness of the crew can also affect production.

The rate of the production line depends on the type of equipment in the line itself. Automatic bag-filling and weighing and automatic bag-closing equipment are substantially faster than a manual operation. Mechanized handling equipment in conjunction with pallets also increases the efficiency of the operation.

Grade-out variations between potato fields and even within the same field cause the production rate to fluctuate regardless of the factors previously mentioned.

### **TOTAL COSTS OF LABOR, MATERIALS, AND EQUIPMENT AT FOUR POTATO PACKING FIRMS**

At firm A, costs per unit for processing potatoes ranged from \$0.289 for No. 1A in 50-pound bags to \$0.971 for No. 1A in master containers with ten 5-pound bags (table 5). At firm B, costs per unit ranged from \$0.353 for No. 2A in 50-pound bags to \$0.915 for No. 1A in master containers with ten 5-pound bags (table 6). At firm C, costs per unit

ranged from \$0.461 for B's in 50-pound bags to \$0.986 for No. 1 in master containers with six 8-pound bags (table 7). At firm D, costs per unit ranged from \$0.610 for B's in 100-pound bags to \$1.027 for No. 1 in master containers with five 10-pound bags (table 8).

TABLE 5.—Total cost of handling, packaging, and loading potatoes at firm A

| Production line    | Potato grade and container  | Containers packed per hour | Weight per hour | Proportion of total weight | Hourly labor cost <sup>1</sup> | Labor cost per unit | Cost per unit              |  |                       |         |                    | Total cost per—      |
|--------------------|-----------------------------|----------------------------|-----------------|----------------------------|--------------------------------|---------------------|----------------------------|--|-----------------------|---------|--------------------|----------------------|
|                    |                             |                            |                 |                            |                                |                     | Hourly labor cost per unit | Depreciated equipment ownership and operation costs <sup>2</sup> | Material <sup>3</sup> | Total   | Truck <sup>4</sup> | Railcar <sup>5</sup> |
|                    |                             |                            |                 |                            |                                |                     |                            |  |                       |         |                    |                      |
|                    |                             | Number                     | Lb              | Percent                    | Dollars                        | Dollars             | Dollars                    | Dollars  | Dollars               | Dollars | Dollars            | Dollars              |
| No. 1A:            |                             |                            |                 |                            |                                |                     |                            |  |                       |         |                    |                      |
| Master containers: |                             |                            |                 |                            |                                |                     |                            |  |                       |         |                    |                      |
| 1                  | Five 10-lb bags             | 173                        | 8,650           | 15.0                       | 38.26                          | 0.221               | 8.01                       | 0.046  | 0.439                 | 0.706   | 540.09             | 1,103.48             |
| 2                  | Ten 5-lb bags               | 110                        | 5,500           | 9.5                        | 35.97                          | .327                | 5.07                       | .046   | .598                  | .971    | 742.82             | 1,517.67             |
| 3                  | 50-lb bags                  | 475                        | 23,750          | 41.3                       | 49.24                          | .104                | 22.04                      | .046   | .139                  | .289    | 221.09             | 451.71               |
| 4                  | No. 2A - 50-lb bags         | 238                        | 11,900          | 20.6                       | 35.70                          | .150                | 10.99                      | .046   | .139                  | .335    | 256.28             | 523.61               |
| 5                  | No. 3 (Jumbos) - 50-lb bags | 43                         | 2,150           | 3.7                        | 6.44                           | .150                | 1.97                       | .046   | .148                  | .344    | 263.16             | 537.67               |
| 6                  | No. 1B - 50-lb bags         | 83                         | 4,150           | 7.2                        | 17.63                          | .212                | 3.84                       | .046   | .139                  | .397    | 303.71             | 620.51               |
| 7                  | No. 2B - 50-lb bags         | 20                         | 1,000           | 1.7                        | 4.23                           | .212                | .91                        | .046   | .350                  | .608    | 465.12             | 950.30               |
| 8                  | Creamers - 50-lb bags       | 12                         | 600             | 1.0                        | 2.53                           | .211                | .53                        | .046   | .139                  | .396    | 302.94             | 618.95               |
| Total              |                             | 1,154                      | 57,700          | 100.0                      | ---                            | ---                 | 53.36                      | ---  | ---                   | ---     | ---                | ---                  |

<sup>1</sup> For hourly labor cost calculations, see pp. 19-20.<sup>2</sup> For total hourly depreciated equipment ownership and operating costs of \$33.36 for firm A, see p. 26.<sup>3</sup> For material cost data, see p. 25.<sup>4</sup> Assumed truckload of 765 master containers (50 or 48 lb) or 400 bags (100 lb).<sup>5</sup> Assumed railcar load of 1,563 master containers (50 or 48 lb) or 800 bags (100 lb).

TABLE 6.—Total cost of handling, packaging, and loading potatoes at firm B

| Production line           | Potato grade and container  | Containers packed per hour | Weight per hour | Proportion of total weight | Hourly labor cost | Labor cost per unit | Cost per unit |                       |                       |       |  | Truck <sup>4</sup> | Railcar <sup>5</sup> |
|---------------------------|-----------------------------|----------------------------|-----------------|----------------------------|-------------------|---------------------|---------------|-----------------------|-----------------------|-------|--|--------------------|----------------------|
|                           |                             |                            |                 |                            |                   |                     | Hourly        | Depreciated equipment | Material <sup>3</sup> | Total |  |                    |                      |
|                           |                             |                            |                 |                            |                   |                     |               |                       |                       |       | ownership and operation costs <sup>2</sup> |                    |                      |
| No. 1A: Master containers |                             |                            |                 |                            |                   |                     |               |                       |                       |       |  |                    |                      |
| 1                         | (ten 5-lb bags)             | 156                        | 7,800           | 29.7                       | 40.00             | 0.256               | 12.68         | 0.081                 | 0.598                 | 0.915 | 699.98                                     | 1,430.15           |                      |
| 2                         | 50-lb bags                  | 226                        | 11,300          | 43.0                       | 32.49             | .144                | 18.37         | .081                  | .139                  | .364  | 278.46                                     | 568.93             |                      |
| 3                         | No. 1B - 50-lb bags         | 37                         | 1,850           | 7.0                        | 7.17              | .194                | 2.99          | .081                  | .139                  | .414  | 316.71                                     | 647.08             |                      |
| 4                         | No. 2B - 50-lb bags         | 12                         | 600             | 2.3                        | 2.33              | .194                | .98           | .081                  | .139                  | .414  | 316.71                                     | 647.08             |                      |
| 5                         | No. 2A - 50-lb bags         | 57                         | 2,850           | 10.9                       | 7.56              | .133                | 4.66          | .081                  | .139                  | .353  | 270.05                                     | 551.74             |                      |
| 6                         | No. 3 (Jumbos) - 50-lb bags | 35                         | 1,750           | 6.7                        | 5.14              | .147                | 2.86          | .081                  | .139                  | .367  | 280.76                                     | 573.62             |                      |
| 7                         | Creamers - 50-lb bags       | 2                          | 100             | .4                         | .39               | .195                | .17           | .085                  | .139                  | .419  | 320.54                                     | 654.90             |                      |
| Total                     |                             | 525                        | 26,250          | 100.0                      |                   |                     | 42.71         |                       |                       |       |  |                    |                      |

<sup>1</sup> For hourly labor cost calculations, see pp. 20-21.<sup>2</sup> For total hourly depreciated equipment ownership and operating costs of \$42.71 for firm B, see p. 26.<sup>3</sup> For material cost data, see p. 25.<sup>4</sup> Assumed truckload of 765 master containers (50 or 48 lb) or 400 bags (100 lb).<sup>5</sup> Assumed railcar load of 1,563 master containers (50 or 48 lb) or 800 bags (100 lb).

TABLE 7.—Total cost of handling, packaging, and loading potatoes at firm C

| Production line    | Potato grade and container | Containers packed per hour | Weight per hour | Proportion of total weight | Hourly labor cost <sup>1</sup> | Labor cost per unit | Cost per unit   |                       |                       |         |                    | Total cost per—      |  |
|--------------------|----------------------------|----------------------------|-----------------|----------------------------|--------------------------------|---------------------|---|-----------------------|-----------------------|---------|--------------------|----------------------|--|
|                    |                            |                            |                 |                            |                                |                     | Hourly cost of ownership and operation costs <sup>2</sup> | Depreciated equipment | Material <sup>3</sup> | Total   | Truck <sup>4</sup> | Railcar <sup>5</sup> |  |
|                    |                            |                            |                 |                            |                                |                     |   |                       |                       |         |                    |                      |  |
|                    |                            | Number                     | Lb              | Percent                    | Dollars                        | Dollars             | Dollars   | Dollars               | Dollars               | Dollars | Dollars            | Dollars              |  |
| No. 1:             |                            |                            |                 |                            |                                |                     |   |                       |                       |         |                    |                      |  |
| Master containers: |                            |                            |                 |                            |                                |                     |   |                       |                       |         |                    |                      |  |
| 1                  | Five 10-lb bags            | 375                        | 18,750          | 19.5                       | 75.38                          | 0.201               | 15.14   | 0.040                 | 0.730                 | 0.971   | 742.82             | 1,517.67             |  |
| 2                  | Six 8-lb bags              | 355                        | 17,040          | 17.7                       | 68.49                          | .193                | 13.74   | .039                  | .754                  | .986    | 754.29             | 1,541.12             |  |
| 3                  | 100-lb bags                | 303                        | 30,300          | 31.5                       | 60.17                          | .199                | 24.55   | .081                  | .350                  | .630    | 252.00             | 504.00               |  |
| 4                  | 50-lb count cartons        | 39                         | 1,950           | 2.0                        | 8.31                           | .213                | 1.55  | .040                  | .430                  | .583    | 522.50             | 1,067.53             |  |
| 5                  | B's - 50-lb bags           | 121                        | 6,050           | 6.3                        | 34.17                          | .282                | 4.89  | .040                  | .139                  | .461    | 352.67             | 720.54               |  |
| 6                  | No. 2 - 100-lb bags        | 184                        | 18,400          | 19.2                       | 49.70                          | .270                | 14.91   | .081                  | .350                  | .701    | 280.40             | 560.80               |  |
| 7                  | Bakers - 100-lb bags       | 24                         | 2,400           | 2.5                        | 5.89                           | .245                | 1.94  | .081                  | .350                  | .676    | 270.40             | 540.80               |  |
| 8                  | Pee wees - 1,150-lb bins   | 1                          | 1,150           | 1.2                        | 3.68                           | NA                  | .93   | NA                    | NA                    | NA      | NA                 | NA                   |  |
| Total              |                            | 1,402                      | 96,040          | 100.0                      | ---                            | ---                 | 77.65   | ---                   | ---                   | ---     | ---                | ---                  |  |

<sup>1</sup> For hourly labor cost calculations, see pp. 22-23.<sup>2</sup> For total hourly depreciated equipment ownership and operating costs of \$77.65 for firm C, see p. 26.<sup>3</sup> For material cost data, see p. 25.<sup>4</sup> Assumed truckload of 765 master containers (50 or 48 lb) or 400 bags (100 lb).<sup>5</sup> Assumed railcar load of 1,563 master containers (50 or 48 lb) or 800 bags (100 lb).

TABLE 8.—Total cost of handling, packaging, and loading potatoes at firm D

| Production line | Potato grade and container | Containers packed per hour | Weight per hour | Proportion of total weight | Hourly labor cost <sup>1</sup> | Labor cost per unit | Cost per unit  |                       |         |                    |                      | Total cost per— |  |
|-----------------|----------------------------|----------------------------|-----------------|----------------------------|--------------------------------|---------------------|--|-----------------------|---------|--------------------|----------------------|-----------------|--|
|                 |                            |                            |                 |                            |                                |                     | Hourly depreciation and ownership costs <sup>2</sup> | Material <sup>3</sup> | Total   | Truck <sup>4</sup> | Railcar <sup>5</sup> |                 |  |
|                 |                            |                            |                 |                            |                                |                     |  |                       |         |                    |                      |                 |  |
| No. 1:          |                            | Number                     | Lb              | Percent                    | Dollars                        | Dollars             | Dollars  | Dollars               | Dollars | Dollars            | Dollars              | Dollars         |  |
| 1               | 100-lb bags                | 461                        | 46,100          | 33.7                       | 137.60                         | 0.299               | 22.73  | 0.049                 | 0.350   | 0.698              | 279.20               | 558.40          |  |
| 2               | 50-lb count cartons        | 490                        | 24,500          | 17.9                       | 79.38                          | .162                | 12.07  | .025                  | .430    | .617               | 472.01               | 964.37          |  |
| 3               | 100-lb bags - bakers       | 44                         | 4,400           | 3.2                        | 10.02                          | .228                | 2.16   | .049                  | .350    | .627               | 250.80               | 501.60          |  |
| 4               | Master containers          |                            |                 |                            |                                |                     |  |                       |         |                    |                      |                 |  |
|                 | (five 10-lb bags)          | 689                        | 34,450          | 25.2                       | 187.69                         | .272                | 16.99  | .025                  | .730    | 1.027              | 785.66               | 1,605.20        |  |
| 5               | No. 2 - 100-lb bags        | 52                         | 5,200           | 3.8                        | 11.01                          | .212                | 2.56   | .049                  | .350    | .611               | 244.40               | 488.80          |  |
| 6               | B's - 100-lb bags          | 117                        | 11,700          | 8.5                        | 24.71                          | .211                | 5.73   | .049                  | .350    | .610               | 244.00               | 488.00          |  |
| 7               | No. 3 - 100-lb bags        | 48                         | 4,800           | 3.5                        | 10.15                          | .212                | 2.36   | .049                  | .350    | .611               | 244.40               | 488.80          |  |
| 8               | Pee wees - 1,150-lb bins   | 5                          | 5,750           | 4.2                        | 8.68                           | NA                  | 2.83   | .566                  | NA      | NA                 | NA                   | NA              |  |
| Total           |                            | 1,906                      | 136,900         | 100.0                      | ---                            | ---                 | 67.43  | ---                   | ---     | ---                | ---                  | ---             |  |

<sup>1</sup> For hourly labor cost calculations, see pp. 23-24.<sup>2</sup> For total hourly depreciated equipment ownership and operating costs of \$67.43 for firm D, see p. 26.<sup>3</sup> For material cost data, see p. 25.<sup>4</sup> Assumed truckload of 765 master containers (50 or 48 lb) or 400 bags (100 lb).<sup>5</sup> Assumed railcar load of 1,563 master containers (50 or 48 lb) or 800 bags (100 lb).

## APPENDIX

### Allocation of Labor Costs per Hour

#### FIRM A

|   |              |
|---|--------------|
| Other labor costs to be allocated by potato grade:  |              |
| 2 primary graders @ \$2.25 .....  | \$4.50       |
| 1 unloader @ \$2.75 .....   | 2.75         |
| 5 handtruckers @ \$2.50 .....   | 12.50        |
| 6 loaders @ \$2.75 .....  | 16.50        |
| 2 plant supervisors @ \$2.75 .....  | 5.50         |
| Total .....   | <u>41.75</u> |
| No. 1A - master containers (five 10-lb bags):   |              |
| Direct labor:   |              |
| 2 lead graders @ \$2.50 .....   | 5.00         |
| 9 graders @ \$2.25 .....  | 20.25        |
| 3 packers @ \$2.25 .....  | 6.75         |
| Total .....   | <u>32.00</u> |
| Allocated other labor: $\$41.75 \times 0.15^1$ .....  | 6.26         |
| Total labor .....   | <u>38.26</u> |
| No. 1A - master containers (ten 5-lb bags):   |              |
| Direct labor .....  | 32.00        |
| Allocated other labor: $\$41.75 \times 0.095^1$ .....                                       | 3.97         |
| Total labor .....   | <u>35.97</u> |
| No. 1A (50-lb bags):  |              |
| Direct labor .....  | 32.00        |
| Allocated other labor: $\$41.75 \times 0.413^1$ .....                                       | 17.24        |
| Total labor .....   | <u>49.24</u> |
| No. 2A (50-lb bags):  |              |
| Direct labor:   |              |
| 2 lead graders @ \$2.50 .....   | 5.00         |
| 10 graders @ \$2.25 .....   | 22.50        |
| 2 packers @ \$2.25 .....  | 4.50         |
| Total (No. 2A's and No. 3's (Jumbos)) .....   | <u>32.00</u> |
| Allocated direct labor - No. 2A's:  |              |
| $\$32.00 \times \frac{11,900 \text{ lb}^2}{14,050 \text{ lb}}$ .....                        | 27.10        |
| Allocated other labor: $\$41.75 \times 0.206^1$ .....                                       | 8.60         |
| Total labor .....   | <u>35.70</u> |
| Jumbos (50-lb bags):  |              |
| Allocated direct labor: $\$32.00 \times \frac{2,150 \text{ lb}^2}{14,050 \text{ lb}}$ ..... | 4.90         |
| Allocated other labor: $\$41.75 \times 0.037^1$ .....                                       | 1.54         |
| Total labor .....   | <u>6.44</u>  |
| No. 1B (50-lb bags):  |              |
| Direct labor:   |              |
| 7 graders @ \$2.25 .....  | 15.75        |
| 2 packers @ \$2.25 .....  | 4.50         |
| Total (No. 1B's, No. 2B's, and creamers) .....  | <u>20.25</u> |

See footnotes at end of table.

## FIRM A—continued

|  |              |
|--|--------------|
| Allocated direct labor: $\$20.25 \times \frac{4,150 \text{ lb}^2}{5,750 \text{ lb}}$ ..... | \$14.62      |
| Allocated other labor: $\$41.75 \times 0.072^1$ .....                                      | 3.01         |
| Total labor .....  | <u>17.63</u> |
| No. 2B (50-lb bags):   |              |
| Allocated direct labor: $\$20.25 \times \frac{1,000 \text{ lb}^2}{5,750 \text{ lb}}$ ..... | 3.52         |
| Allocated other labor: $\$41.75 \times 0.017^1$ .....                                      | .71          |
| Total labor .....  | <u>4.23</u>  |
| Creamers (50-lb bags):   |              |
| Allocated direct labor: $\$20.25 \times \frac{600 \text{ lb}^2}{5,750 \text{ lb}}$ .....   | 2.11         |
| Allocated other labor: $\$41.75 \times 0.010^1$ .....                                      | .42          |
| Total labor .....  | <u>2.53</u>  |

## FIRM B

|  |                           |                |
|--|---------------------------|----------------|
| Other labor costs to be allocated by potato grade:                   |                           |                |
| 2 graders @ \$2.50 .....   |                           | \$5.00         |
| 2 unloaders @ \$2.90 .....   |                           | 5.80           |
| 4 loaders @ \$2.75 .....   |                           | 11.00          |
| 1 forklift operator @ \$2.75 .....                                   |                           | 2.75           |
| Total .....  |                           | <u>24.55</u>   |
| No. 1A — master containers (ten 5-lb bags):                          |                           |                |
| Direct labor:  |                           |                |
| 8 packers @ \$2.50 .....   |                           | 20.00          |
| 1 packer @ \$2.75 .....  |                           | 2.75           |
| Total .....  |                           | <u>\$22.75</u> |
| Method of allocating direct labor by percent mix of potato packages: |                           |                |
|  | <i>Pounds<sup>3</sup></i> | <i>Percent</i> |
| Master containers (ten 5-lb bags) .....                              | 7,800                     | 32.9           |
| 50-lb baler bags .....   | 11,300                    | 47.7           |
| No. 2A .....   | 2,850                     | 12.0           |
| No. 3 (Jumbos) .....   | 1,750                     | 7.4            |
|  | <u>23,700</u>             | <u>100.00</u>  |
| Allocated direct labor:  |                           |                |
| 1 lead grader @ $\$2.75 \times 0.329$ .....                          |                           | 0.91           |
| 11 graders @ $\$2.50 = \$27.50 \times 0.329$ .....                   |                           | 9.05           |
| Allocated other labor: $\$24.55 \times 0.297^{1,3}$ .....            |                           | 7.29           |
| Total .....  |                           | <u>17.25</u>   |
| Total labor .....  |                           | <u>40.00</u>   |
| No. 1A (50-lb bags):   |                           |                |
| Direct labor: 3 packers (baggers) @ \$2.50 .....                     |                           | 7.50           |
| Allocated direct labor:  |                           |                |
| 1 lead grader @ $\$2.75 \times 0.477$ .....                          |                           | 1.31           |
| 11 graders @ $\$27.50 \times 0.477$ .....                            |                           | 13.12          |
| Total .....  |                           | <u>14.43</u>   |
| Allocated other labor: $\$24.55 \times 0.430^1$ .....                |                           | 10.56          |
| Total labor .....  |                           | <u>32.49</u>   |

See footnotes at end of table.

OPERATING COSTS AT FOUR POTATO PACKING PLANTS

21

|   |        |
|---|--------|
| No. 2A (50-lb bags):                                |        |
| Direct labor: 1/2 packer @ \$2.50                   | \$1.25 |
| Allocated direct labor:                             |        |
| 1 lead grader @ \$2.75 × 0.120                      | .33    |
| 11 graders @ \$27.50 × 0.120                        | 3.80   |
| Total   | 3.63   |
| Allocated other labor: \$24.55 × 0.109 <sup>1</sup> | 2.68   |
| Total labor   | 7.56   |

|   |      |
|---|------|
| No. 3 (Jumbos) (50-lb bags):                        |      |
| Direct labor: 1/2 packer @ \$2.50                   | 1.25 |
| Allocated direct labor:                             |      |
| 1 loader @ \$2.75 × 0.074                           | .20  |
| 11 graders @ \$27.50 × 0.074                        | 2.04 |
| Total   | 2.24 |
| Allocated other labor: \$24.55 × 0.067 <sup>1</sup> | 1.65 |
| Total labor   | 5.14 |

No. 1B (50-lb bags):  
Method of allocating direct labor by percent mix of 3 potato grades:

|   | Pounds <sup>2</sup> | Percent |
|---|---------------------|---------|
| No. 1B  | 1,850               | 72.6    |
| Creamers  | 100                 | 3.9     |
| No. 2B  | 600                 | 23.5    |
|   | 2,550               | 100.0   |
| 3 packers @ \$2.50 = \$7.50 × 0.726                 |                     | 5.45    |
| Allocated other labor: \$24.55 × 0.070 <sup>1</sup> |                     | 1.72    |
| Total labor   |                     | 7.17    |

|   |     |
|---|-----|
| Creamers (50-lb bags):                              |     |
| Allocated direct labor: \$7.50 × 0.039              | .29 |
| Allocated other labor: \$24.55 × 0.004 <sup>1</sup> | .10 |
| Total labor   | .39 |

|   |      |
|---|------|
| No. 2B (50-lb bags):                                |      |
| Allocated direct labor: \$7.50 × 0.235              | 1.76 |
| Allocated other labor: \$24.55 × 0.023 <sup>1</sup> | .57  |
| Total labor   | 2.33 |

FIRM C

|  |         |
|--|---------|
| Other labor costs to be allocated by potato grade: |         |
| 25 graders @ \$2.40                                | \$60.00 |
| 1 supergrader @ \$2.60                             | 2.60    |
| 2 maintenance helpers @ \$2.50                     | 5.00    |
| 1 maintenance foreman @ \$2.69                     | 2.69    |
| 3 miscellaneous helpers @ \$2.50                   | 7.50    |
| Total  | 77.79   |

|  |        |
|--|--------|
| No. 1 - master containers (five 10-lb bags and six 8-lb bags): |        |
| Direct labor:  |        |
| 24 baggers + 1 grader @ \$2.40                                 | 60.00  |
| 13 packers @ \$2.75  | 35.75  |
| 5 loaders @ \$3.00   | 15.00  |
| 1 foreman @ \$200 per week                                     | 4.17   |
| Total  | 114.92 |

See footnotes at end of table.



## FIRM C—continued

|   |       |              |
|---|-------|--------------|
| Allocated direct labor – master containers (five 10-lb bags):   |       |              |
| $\$114.92 \times \frac{18,750 \text{ lb}^4}{35,790 \text{ lb}}$   | ----- | \$60.21      |
| Allocated other labor: $\$77.79 \times 0.195^1$   | ----- | 15.17        |
| Total labor   | ----- | <u>75.38</u> |
| Allocated direct labor – master containers (six 8-lb bags):   |       |              |
| $\$114.92 \times \frac{17,040 \text{ lb}^4}{35,790 \text{ lb}}$   | ----- | 54.72        |
| Allocated other labor: $\$77.79 \times 0.177^1$   | ----- | 13.77        |
| Total labor   | ----- | <u>68.49</u> |
| No. 1 (100-lb bags):  |       |              |
| Direct labor:   |       |              |
| 4 baggers @ \$2.75  | ----- | 11.00        |
| 1 foreman @ \$5.21  | ----- | 5.21         |
| Total   | ----- | \$16.21      |
| Allocated direct labor:   |       |              |
| 11 loaders @ \$33.00 = \$33.00 $\times \frac{30,000 \text{ lb}^5}{59,100 \text{ lb}}$   | ----- | 16.92        |
| 1 foreman $\frac{96,040 \text{ lb per cwt} \times \$0.005}{100 \text{ lb per cwt}} = \$4.80 \times \frac{30,300 \text{ lb}}{59,100 \text{ lb}}$ | ----- | 2.46         |
| Total   | ----- | 19.38        |
| Allocated other labor: $\$77.79 \times 0.316^1$   | ----- | 24.58        |
| Total labor   | ----- | <u>60.17</u> |
| No. 1 (50-lb count cartons):  |       |              |
| Direct labor:   |       |              |
| 1 packer @ \$2.75   | ----- | 2.75         |
| 1 sealer @ \$2.75   | ----- | 2.75         |
| Total   | ----- | 5.50         |
| Allocated direct labor:   |       |              |
| 11 loaders @ \$33.00 $\times \frac{1,950 \text{ lb}^5}{59,100 \text{ lb}}$  | ----- | 1.09         |
| 1 foreman @ \$4.80 $\times \frac{1,950 \text{ lb}^5}{59,100 \text{ lb}}$  | ----- | .16          |
| Total   | ----- | 1.25         |
| Allocated other labor: $\$77.79 \times 0.020^1$   | ----- | 1.56         |
| Total labor   | ----- | <u>8.31</u>  |
| B's (50-lb bags):   |       |              |
| Direct labor:   |       |              |
| 6 graders @ \$2.40  | ----- | 14.40        |
| 4 baggers @ \$2.75  | ----- | 11.00        |
| Total   | ----- | 25.40        |
| Allocated direct labor:   |       |              |
| 11 loaders @ \$33.00 $\times \frac{6,050 \text{ lb}^5}{59,100 \text{ lb}}$  | ----- | 3.38         |
| 1 foreman @ \$4.80 $\times \frac{6,050 \text{ lb}^5}{59,100 \text{ lb}}$  | ----- | .49          |
| Total   | ----- | 3.87         |
| Allocated other labor: $\$77.79 \times 0.063^1$   | ----- | 4.90         |
| Total labor   | ----- | <u>34.17</u> |

See footnotes at end of table.

OPERATING COSTS AT FOUR POTATO PACKING PLANTS

23

No. 2 (100-lb bags):

|  |       |         |
|--|-------|---------|
| Direct labor:  |       |         |
| 4 baggers @ \$2.75   | ----- | \$11.00 |
| 5 graders @ \$2.40   | ----- | 12.00   |
| Total  | ----- | \$23.00 |
| Allocated direct labor:  |       |         |
| 11 loaders @ \$33.00 × $\frac{18,400 \text{ lb}^5}{59,100 \text{ lb}}$ | ----- | 10.27   |
| 1 foreman @ \$4.80 × $\frac{18,400 \text{ lb}^5}{59,100 \text{ lb}}$   | ----- | 1.49    |
| Total  | ----- | 11.76   |
| Allocated other labor: \$77.79 × 0.192 <sup>1</sup>                    | ----- | 14.94   |
| Total labor  | ----- | 49.70   |

Bakers (100-lb bags):

|   |       |      |
|---|-------|------|
| Direct labor: 1 grader @ \$2.40                                       | ----- | 2.40 |
| Allocated direct labor:   |       |      |
| 11 loaders @ \$33.00 × $\frac{2,400 \text{ lb}^5}{59,100 \text{ lb}}$ | ----- | 1.84 |
| 1 foreman @ \$4.80 × $\frac{2,400 \text{ lb}^5}{59,100 \text{ lb}}$   | ----- | .20  |
| Total   | ----- | 1.54 |
| Allocated other labor: \$77.79 × 0.025 <sup>1</sup>                   | ----- | 1.95 |
| Total labor   | ----- | 5.89 |

Pee wees (small culls) (1,150-lb bins):

|   |       |      |
|---|-------|------|
| Direct labor: 1 operator @ \$2.75                   | ----- | 2.75 |
| Allocated other labor: \$77.79 × 0.012 <sup>1</sup> | ----- | .93  |
| Total labor   | ----- | 3.68 |

FIRM D

Other labor costs to be allocated by potato grade:

|  |       |         |
|--|-------|---------|
| 27 graders @ \$2.35  | ----- | \$63.45 |
| 1 maintenance helper @ \$2.50  | ----- | 2.50    |
| 1 maintenance foreman @ \$2.69   | ----- | 2.69    |
| 3 cleanup and miscellaneous helpers @ \$2.50   | ----- | 7.50    |
| Total  | ----- | 76.14   |
| 3 foremen $\frac{\$0.03 \times 2,170,000 \text{ lb}}{50 \text{ lb} \times 20 \text{ h}}$ | ----- | 65.10   |
| Total labor  | ----- | 141.24  |

No. 1 (100-lb bags):

|  |       |        |
|--|-------|--------|
| Direct labor: 9 frontmen (loaders) @ \$10.00         | ----- | 90.00  |
| Allocated other labor: \$141.24 × 0.337 <sup>1</sup> | ----- | 47.60  |
| Total labor  | ----- | 137.60 |

Bakers (100-lb bags):

|   |       |       |
|---|-------|-------|
| Direct labor: 2 sidemen @ \$2.75 (1 bagger, 1 loader) | ----- | 5.50  |
| Allocated other labor: \$141.24 × 0.032 <sup>1</sup>  | ----- | 4.52  |
| Total labor   | ----- | 10.02 |

No. 1 (50-lb count cartons):

|  |       |       |
|--|-------|-------|
| Direct labor:  |       |       |
| 12 graders @ \$2.35                                  | ----- | 28.20 |
| 6 sidemen (loaders) @ \$2.75                         | ----- | 16.50 |
| 4 baggers @ \$2.35                                   | ----- | 9.40  |
| Total  | ----- | 54.10 |
| Allocated other labor: \$141.24 × 0.179 <sup>1</sup> | ----- | 25.28 |
| Total labor  | ----- | 79.38 |

See footnotes at end of table.

## FIRM D—continued

## No. 1 – master containers (five 10-lb bags):

|  |         |
|--|---------|
| Direct labor:  |         |
| 13 sidemen (10 packers, 3 sewers (sidemen)) @ \$2.75 | \$35.75 |
| 2 frontmen (loaders) @ \$10.00                       | 20.00   |
| 41 baggers @ \$2.35                                  | 96.35   |
| Total  | 152.10  |
| Allocated other labor: \$141.24 × 0.252 <sup>1</sup> | 35.59   |
| Total labor  | 187.69  |

## No. 3 (100-lb bags):

Direct labor (allocated by percent of weight of No. 2's, No. 3's, and B's):

|   |       |
|---|-------|
| 1 grader @ \$2.35   | 2.35  |
| 6 sidemen @ \$2.75  | 16.50 |
| 2 graders @ \$2.35  | 4.70  |
| Total   | 23.55 |
| Allocated direct labor: $23.55 \times \frac{4,800 \text{ lb}^6}{21,700 \text{ lb}}$ | 5.21  |
| Allocated other labor: \$141.24 × 0.035 <sup>1</sup>                                | 4.94  |
| Total labor   | 10.15 |

## No. 2 (100-lb bags):

Direct labor: Allocated direct labor:

|   |       |
|---|-------|
| $\frac{23.55 \times 5,200 \text{ lb}^6}{21,700 \text{ lb}}$ | 5.64  |
| Allocated other labor: \$141.24 × 0.038 <sup>1</sup>        | 5.37  |
| Total labor   | 11.01 |

## B's (100-lb bags):

|  |       |
|--|-------|
| Direct labor: Allocated direct labor: $23.55 \times \frac{11,700 \text{ lb}^6}{21,700 \text{ lb}}$ | 12.70 |
| Allocated other labor: \$141.24 × 0.085 <sup>1</sup>   | 12.01 |
| Total labor  | 24.71 |

## Pee wees (1,150-lb bins):

|  |      |
|--|------|
| Direct labor: 1 @ \$2.75                             | 2.75 |
| Allocated other labor: \$141.24 × 0.042 <sup>1</sup> | 5.93 |
| Total labor  | 8.68 |

<sup>1</sup> Percentage of weight of grade packed to total weight of all potato grades packed. See tables 5–8.<sup>2</sup> See table 5.<sup>3</sup> See table 6.<sup>4</sup> See table 7.<sup>5</sup> Break up percentagewise among No. 1's, B's, No. 2's, bakets, and counts (see table 7 and footnote 1).<sup>6</sup> See table 8.

## Material Costs

The same material costs were used for all four firms studied in order to make the cost comparisons more valid. These costs for packages commonly used at potato packing plants were as follows:

| Types of packages                        | Cost per unit <sup>1</sup> |
|--|----------------------------|
| Consumer paper bags:                     |                            |
| 5 lb.....                                | \$0.045                    |
| 8 lb.....                                | .054                       |
| 10 lb.....                               | .060                       |
| 20 lb.....                               | .094                       |
| Consumer plastic bags:                   |                            |
| 5 lb.....                                | .022                       |
| 10 lb.....                               | .036                       |
| Master cardboard containers (50 lb)..... | .430                       |
| Burlap bags:                             |                            |
| 50 lb.....                               | .290                       |
| 100 lb.....                              | .350                       |

<sup>1</sup> March 1975 costs obtained from Bemis Bag Co., Inc., New York, N. Y., Western Potato Association, Bakersfield, Calif., and other manufacturers of bags and containers in Florida and Maine.

## Equipment Costs

The cost of equipment used at the four firms was as follows:

| FIRM A  |          |
|---|----------|
| 1 hydraulic flume and initial wash .....                          | \$18,300 |
| 1 conveyor, screen rock, spray washer, and water eliminator ..... | 18,000   |
| 1 soak tank .....   | 475      |
| 1 drying system .....   | 15,000   |
| 1 screen sizer, 2-inch .....                                      | 400      |
| 1 main grading station .....                                      | 925      |
| 1 accumulating conveyor .....                                     | 1,500    |
| 1 secondary grading station .....                                 | 450      |
| 1 small secondary grading station .....                           | 385      |
| 1 ACC 4-position automatic 50-lb bag filler .....                 | 12,150   |
| 3 metal loop baler bag closers .....                              | 9,000    |
| 1 wire bag closer .....   | 2,995    |
| 1 rotary table .....  | 900      |
| 10 single-head and twin-head 50-lb baler bag-filling heads .....  | 40,000   |
| 5- and 10-lb packaging equipment .....                            | 16,000   |
| Rubber belt conveyors:  |          |
| 12 inch (217 ft) .....  | 5,208    |
| 18 inch (252 ft) .....  | 9,072    |
| 24 inch (51 ft) .....   | 2,448    |
| Roller conveyors:   |          |
| 24 inch (14 ft) .....   | 98       |
| 30 inch (12 ft) .....   | 84       |
| 60 inch (139 ft) .....  | 2,780    |
| Total .....   | 166,170  |

## FIRM B

|   |
|---|
| 6 scale platforms                       |
| 1 water eliminator                      |
| 1 dryer                                 |
| 1 screen sizer, 2-inch                  |
| 1 grading table                         |
| 2 scales                                |
| 4 loading dock boards                   |
| 1 bag scale                             |
| 2 handtrucks, 2-wheel                   |
| 1 extension conveyor                    |
| 1 hydraulic unloading system            |
| 1 bagging line - 5- and 10-lb bags      |
| 1 clod and rock eliminator system       |
| 1 double-head bagger                    |
| 1 bag rack and blowers for Tew heads    |
| 1 bag closer                            |
| 1 bag-filling holder, 3-position, 50-lb |
| 2 loop bag closers                      |
| 2 pallet trucks                         |
| 1 dock board                            |
| 1 bag closer (wire ring)                |
| 410 pallets                             |
| 1 forklift truck                        |
| 1 automatic baler bag                   |
| 1 filler (1970)                         |
| 1 brush washer                          |
| 1 belt conveyor, 8-ft                   |
| 1 conveyor take-away belt               |
| 1 grade sizer for B potatoes            |
| 2 grade tables for B potatoes           |
| 1 bulk feed conveyor                    |

Total estimated cost: \$125,000

## FIRM C

|   |          |
|---|----------|
| 4 flume pumps .....                           | \$12,000 |
| 2 vibrating chain sizers .....                | 3,780    |
| 1 washer .....                                | 6,200    |
| 1 roller sizer .....                          | 16,100   |
| 3 weigh-o-matics (8- and 10-lb bagging) ..... | 57,000   |
| 1 carton filler .....                         | 5,500    |
| 1 vibrator .....                              | 2,500    |
| 2 carton sealers .....                        | 21,000   |
| 3 bagging machines, 50- and 100-lb .....      | 45,300   |
| Rubber belt conveyors:                        |          |
| 12 inch (260 ft) .....                        | 6,240    |
| 18 inch (510 ft) .....                        | 18,360   |
| 24 inch (300 ft) .....                        | 14,400   |
| 36 inch (85 ft) .....                         | 4,590    |
| 48 inch (165 ft) .....                        | 11,160   |
| Aluminum roller conveyors:                    |          |
| 12 inch (25 ft) .....                         | 175      |
| 18 inch (260 ft) .....                        | 1,820    |
| 24 inch (115 ft) .....                        | 1,035    |
| 36 inch (10 ft) .....                         | 110      |
| Total .....                                   | 227,270  |

| FIRM D                            |       |         |
|-----------------------------------|-------|---------|
| 2 vibrating chain sizers, 60-inch | ----- | \$3,780 |
| 3 washers                         | ----- | 18,600  |
| 1 roller sizer                    | ----- | 16,100  |
| 1 count sizer, 2 lanes            | ----- | 41,000  |
| 2 carton-sealing machines         | ----- | 25,000  |
| 2 weigh-o-matics                  | ----- | 38,000  |
| 1 even flow                       | ----- | 5,950   |
| 1 rot trap                        | ----- | 1,835   |
| Rubber belt conveyors:            |       |         |
| 12 inch (234 ft)                  | ----- | 5,616   |
| 18 inch (120 ft)                  | ----- | 4,320   |
| 24 inch (337 ft)                  | ----- | 16,176  |
| 36 inch (115 ft)                  | ----- | 6,210   |
| 48 inch (15 ft)                   | ----- | 1,080   |
| Aluminum roller conveyors:        |       |         |
| 12 inch (21 ft)                   | ----- | 147     |
| 18 inch (21 ft)                   | ----- | 147     |
| 24 inch (10 ft)                   | ----- | 90      |
| 36 inch (52 ft)                   | ----- | 572     |
| 48 inch (20 ft)                   | ----- | 300     |
| 60 inch (41 ft)                   | ----- | 820     |
| Total                             | ----- | 185,743 |

### Ownership and Operating Costs

The ownership and operating costs at the four firms were as follows:

|                                  | Per year <sup>1</sup> | Per hour |
|----------------------------------|-----------------------|----------|
| FIRM A                           |                       |          |
| Ownership costs:                 |                       |          |
| Depreciation <sup>2</sup>        | \$15,617.00           | \$26.03  |
| Interest <sup>3</sup>            | 4,685.10              | 7.81     |
| Insurance and taxes <sup>4</sup> | 6,246.80              | 10.41    |
| Operating costs:                 |                       |          |
| Power <sup>5</sup>               | 3,123.40              | 5.21     |
| Maintenance <sup>6</sup>         | 2,342.55              | 3.90     |
| Total                            | 32,014.85             | 53.36    |

|                                  | Per year <sup>1</sup> | Per hour |
|----------------------------------|-----------------------|----------|
| FIRM B                           |                       |          |
| Ownership costs:                 |                       |          |
| Depreciation <sup>2</sup>        | \$12,500.00           | \$20.83  |
| Interest <sup>3</sup>            | 3,750.00              | 6.25     |
| Insurance and taxes <sup>4</sup> | 5,000.00              | 8.33     |
| Operating costs:                 |                       |          |
| Power <sup>5</sup>               | 2,500.00              | 4.17     |
| Maintenance <sup>6</sup>         | 1,875.00              | 3.13     |
| Total                            | 25,625.00             | 42.71    |

| FIRM C                           |             |         |
|----------------------------------|-------------|---------|
| Ownership costs:                 |             |         |
| Depreciation <sup>2</sup>        | \$22,727.00 | \$37.88 |
| Interest <sup>3</sup>            | 6,818.10    | 11.36   |
| Insurance and taxes <sup>4</sup> | 9,090.80    | 15.15   |
| Operating costs:                 |             |         |
| Power <sup>5</sup>               | 4,545.40    | 7.58    |
| Maintenance <sup>6</sup>         | 3,409.05    | 5.68    |
| Total                            | 46,590.35   | 77.65   |

| FIRM D                           |             |         |
|----------------------------------|-------------|---------|
| Ownership costs:                 |             |         |
| Depreciation <sup>2</sup>        | \$19,734.30 | \$32.89 |
| Interest <sup>3</sup>            | 5,920.29    | 9.87    |
| Insurance and taxes <sup>4</sup> | 7,893.72    | 13.16   |
| Operating costs:                 |             |         |
| Power <sup>5</sup>               | 3,946.86    | 6.58    |
| Maintenance <sup>6</sup>         | 2,960.15    | 4.93    |
| Total                            | 40,455.32   | 67.43   |

<sup>1</sup> Based on 600 h (10 weeks at 60 h per week) per year.

<sup>2</sup> Straight-line depreciation based on 10-yr life expectancy.

<sup>3</sup> At 3 percent of total equipment cost or 6 percent of depreciated balance.

<sup>4</sup> At 4 percent of total equipment costs.

<sup>5</sup> At 2 percent of total equipment costs.

<sup>6</sup> At 1.5 percent of total equipment costs.

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